

A new *Orbitestella* (Gastropoda: Heterobranchia: Orbitestellidae) from Tierra del Fuego, Argentina

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ABSTRACT

A new species of *Orbitestella* is described from Tierra del Fuego, Argentina. The morphology of the jaws is the main character used for the generic allocation. *Orbitestella patagonica* new species is characterized by a widely umbilicated shell with low spire, ornamented with numerous, regularly distributed, spiral threads and weak sinuous commarginal growth lines. The entire surface of the protoconch is covered with crisp spiral threads. Examination of the anatomy revealed the presence of a relatively small stomach and the posterior region of genital system bulging into haemocoel space as main distinguishing characters.

INTRODUCTION

The Orbitestellidae are extremely minute, discoid, and widely umbilicated gastropods, living mainly in the Southern Hemisphere (Ponder, 1967, 1990; Powell, 1979). The genus *Orbitestella* Iredale, 1917 has a virtually worldwide distribution, although most of the known species occur in Australia and New Zealand (Ponder, 1990; Ponder and Keyser, 1998). In the north Atlantic, two species have been described by Rolán and Rubio (1992): *O. similis* from Cape Verde and *O. cubana* from Cuba. The only species of the genus presently known from off South America is *Orbitestella ponderi* Linse, 2002, a species described from the East Beagle Channel (Tierra del Fuego). Linse (2002) identified as *O. ponderi* specimens from southern Chile previously reported by Ponder (1990) as *Orbitestella* sp.

Orbitestella has previously been placed in the Trochoidea or Truncatelloidea, either in the Omalogyridae or Orbitestellidae (Iredale, 1917; Thiele, 1929; Knight et al., 1960). Ponder (1967), based on the structure of the animals and radula, placed *Orbitestella* in the Rissooidea [as Rissoacea]. This point of view was followed by several subsequent authors (Powell, 1979; Ponder, 1983; Marshall, 1988; Hickman and McLean, 1990). Later on, Ponder (1990) after having studied the anatomy of two orbitestellid species [*Orbitestella warenti* Ponder, 1990,

and *Microdiscula charopa* (Tate, 1899)] suggested that Orbitestellidae should not be considered as rissooidean but as primitive Heterobranchia, related to the northern-hemisphere freshwater family Valvatidae. Ponder and Warén (1988) placed Orbitestellidae in the Valvatoidea.

In the present paper a new species of *Orbitestella* from the Magellanic Region is described on the basis of shell morphology and general anatomy.

MATERIALS AND METHODS

The studied specimens were collected at the Beagle Channel, Tierra del Fuego, Argentina (Figure 1). Samples were taken with a dragnet, fixed in 10% buffered formalin and transported to the laboratory where mollusks were sorted from sediments using a stereoscopic microscope, and preserved in 70% ethanol. Shell, radula, jaws, and operculum morphology were studied and illustrated using scanning electron microscopy (SEM). For anatomical studies specimens were decalcified in Railliet-Henry's solution. Two specimens were processed for histology. Semi-thin sections (0.3 µm thick) were stained with Mallory's trichrome (Gabe, 1968). Additionally, 5 specimens were dissected under stereomicroscope. It was not possible to study the right side of these specimens (i.e. pallial tentacle, penis, and propodial flap).

Voucher specimens were deposited in the Museo de La Plata (MLP) and Museu de Zoologia da Universidade de São Paulo (MZSP).

Abbreviations used in the figures: **ad**, anterior lobe of digestive gland; **an**, anus; **ca**, capsule gland; **ce**, cerebral ganglion; **cg**, pallial genital gland; **cm**, columellar muscle; **cs**, crystalline style sac; **dg**, digestive gland; **es**, esophagus; **ey**, eye; **fs**, foot sole; **ft**, foot; **h**, heart; **go**, hermaphrodite gonad; **gp**, pedal ganglion; **hy**, inner shell organic layer (hypostracum); **in**, intestine; **jw**, jaw plate; **mb**, mantle border; **mf**, mantle U-shaped fold; **mg**, mantle gland; **mo**, mouth; **od**, odontophore; **ol**,

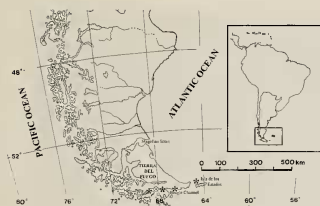


Figure 1. Map showing the type locality (⊗) of *Orbitostella patagonica* new species and new findings of *O. ponderi* (*).

periostracum; **op**, operculum; **os**, osphradium; **pa**, posterior lobe of pedal gland; **pe**, periostracum; **pg**, posterior mucous gland; **po**, pigmented mantle organ; **pr**, propodium; **pt**, prostate; **ro**, renal organ; **sg**, salivary gland; **st**, stomach; **sv**, seminal vesicle; **sy**, statocyst; **te**, cephalic tentacle.

SYSTEMATICS

Genus *Orbitostella* Iredale, 1917 (Type species: *Cyclostrema bastowi* Gatliff, 1906, by original designation)

Orbitostella patagonica new species
(Figures 2–18)

Diagnosis: Shell minute, discoid, with low spire, widely umbilicated, ornamented with weak sinuous commarginal growth lines and numerous, regularly distributed spiral threads. Protoconch with crisp spiral threads covering entire surface. Radula with wide, pectinated rachidian tooth with sharply pointed cusps; lateral tooth plate-like, with a main cusp and sparsely serrated outer margin; marginal tooth slender, sickle-like. Stomach relatively small.

Description: **SHELL** (Figures 2–6, 8–10): Minute (maximum diameter 1.1 mm), discoid, widely umbilicated, thin, translucent, shiny, up to 2.75 rounded and regularly expanding whorls; spire depressed, slightly raised (Figures 2–5). Color yellowish-buff. Periostracum thin, colorless. Protoconch formed by 0.75 whorl, about 200 μ m wide; initially only sculptured with low granulations, followed by 10–12 spiral threads (Figure 6). First 0.25 whorl weakly marked by straight growth disruption (Figure 6). Teleoconch of up to 2 rounded whorls, suture incised. Umbilicus deep, wide, representing about 32% of maximum shell diameter (Figure 5). Shell surface with weak, sinuous commarginal growth lines and numerous, regularly distributed and fine spiral threads (Figure 8), also visible inside umbilicus (Figure 5); first whorl of teleoconch with about 10 spiral threads, last whorl with 35–37. Shell aperture nearly circular (about 240 μ m high by 270 μ m wide) with sinuous peristome (Figures 4, 5).

SHELL ULTRASTRUCTURE: Only one well-defined crossed-lamellar layer, about 25 μ m thick (Figure 9). Organic layer (hy), a third of periostracum thickness, made more evident in decalcified shell (Figure 16).

HEAD-FOOT (FIGURES 11, 16): Color cream-yellowish, uniform in preserved specimens. Head inlaid into foot (Figure 11). Pair of cephalic tentacles well developed. Eyes relatively large, sunken into integument medially between bases of cephalic tentacles; lens solid, volume about half that of eyes (Figure 16). A pair of tentacle-like flaps (sometimes referred to as a “snout”) lying between tentacle bases, flanking mouth. Foot somewhat massive, cylindrical when retracted, occupying $\frac{1}{4}$ whorl; sole entirely covered by long cilia. Columellar muscle thick. Posterior mucous gland occupying posterior and middle region of foot.

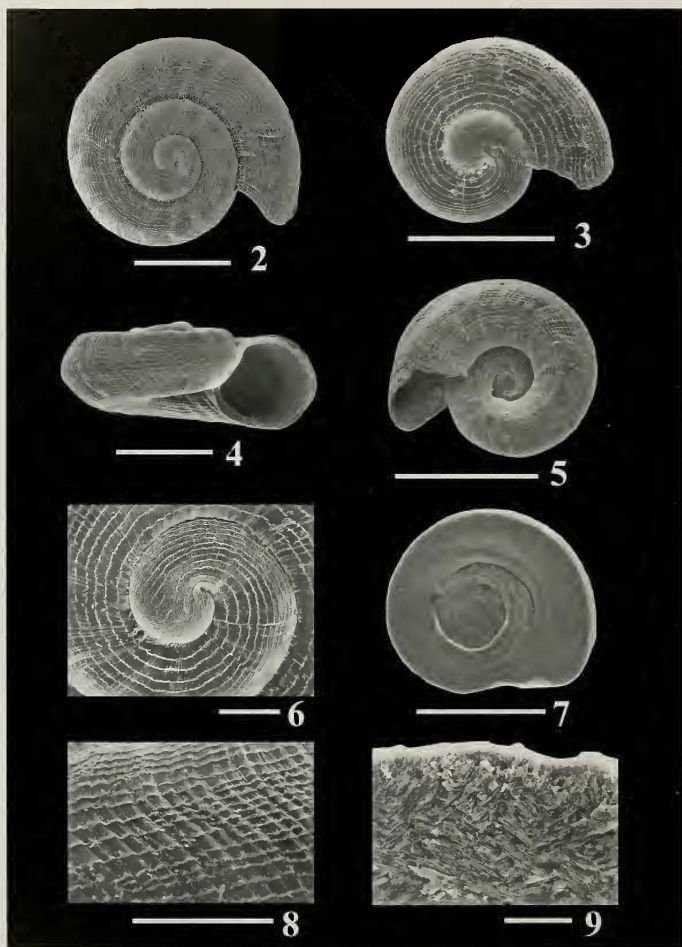
OPERCULUM (FIGURE 7): Nearly circular, paucispinal, up to 3.5 slightly overlapping whorls, horny, thin, translucent, yellowish; nucleus subcentral.

PALLIAL CAVITY (FIGURES 16, 17): Expanded by $\frac{1}{4}$ whorl, with thin, simple mantle border. Gill absent. U-shaped low fold, sometimes described as “a short, partially ciliated lobe”, dorsally located (Figure 17, mf). Osphradium small, fold-like, ciliated, located on left side. Pigmented mantle gland (seen by transparency) circular, thin, relatively small, color dark brown, surface uniform, located at middle-posterior part of roof of pallial cavity (Figure 9, po).

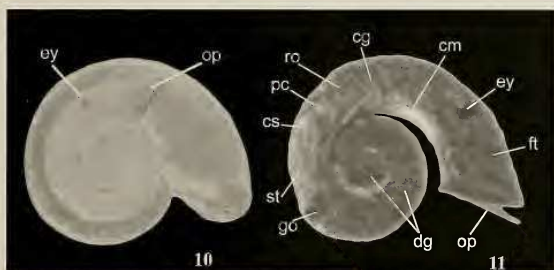
VISCERAL MASS (FIGURES 11, 16, 17): Comprising two whorls. Digestive gland almost fully developed on last whorl. Stomach and gonad located in first half of visceral whorls, stomach in right side, gonad in left (Figure 16).

CIRCULATORY AND EXCRETORY SYSTEMS (FIGURE 16): Heart small, located between stomach and renal organ, posterior to pallial cavity. Renal organ triangular in section.

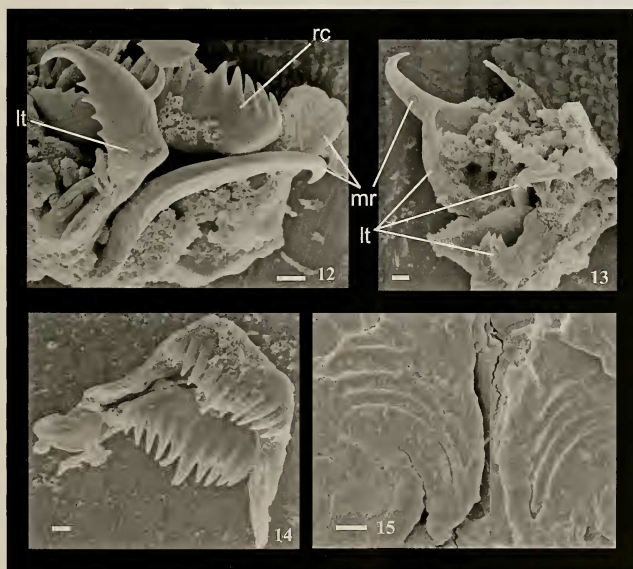
DIGESTIVE SYSTEM: **Mouth** on a small protuberance, between tentacle-like flaps (Figure 16). Oral tube narrow, laterally expanded. **Jaw plates** large, rounded, laterally located and flanked by well-developed muscles (Figure 16); with five serrated rows of simple curved plates, posteriorly concave, on each side of inner surface (Figure 15). Odontophore similar to jaws in size, with several small muscles, but no cartilages (Figure 16). **Radula** 1:1:1:1:1, somewhat longer than odontophore. (Figure 12). **Rachidian tooth** large, trapezoidal, with peg-like lateral edges and an excavated base; cutting edge pectinated, wide, strongly curved inwards, bearing 11–13 slender and sharply pointed cusps, gradually becoming smaller in outward direction; central cusp straight; lateral cusps somewhat curved, narrower than central one (Figure 14). **Lateral teeth** plate-like with straight base; cutting edge with a large primary cusp, 4–5 smaller and regularly separated cusps on outer side, and a small inner side cusp, on base of primary cusp (Figure 12). **Marginal teeth** sickle-like, slender, gradually narrowing to sharply pointed tip; secondary cusps,



Figures 2-9. *Orbitestella patagonica* new species. 2. Holotype, MLP 6367. 3-7. Paratypes, MLP 6368. 3. Dorsal view. 4. Lateral view. 5. Ventral view. 6. Detail of the protoconch. 7. Operculum. 8. Shell surface sculpture. 9. Shell ultrastructure. Scale bars: Figures 2-4 = 300 μ m; Figures 5 = 500 μ m; Figures 6-8 = 100 μ m; Figure 9 = 20 μ m.



Figures 10–11. *Orbitestella patagonica*. Paratypes, MZSP 38708. **10.** Dorsal view of a specimen seen by transparency. **11.** Right view of a specimen removed from shell. Scale bars = 600 μm .



Figures 12–15. *Orbitestella patagonica*. SEM micrographs of the radula (MZSP 38708). **12.** Rachidian (rc), lateral (lt) and marginal (mr) teeth (dislodged). **13.** Detail of lateral (lt) and marginal (mr) teeth. **14.** Detail of rachidian teeth. **15.** Jaws. Scale bars = 1 μm .

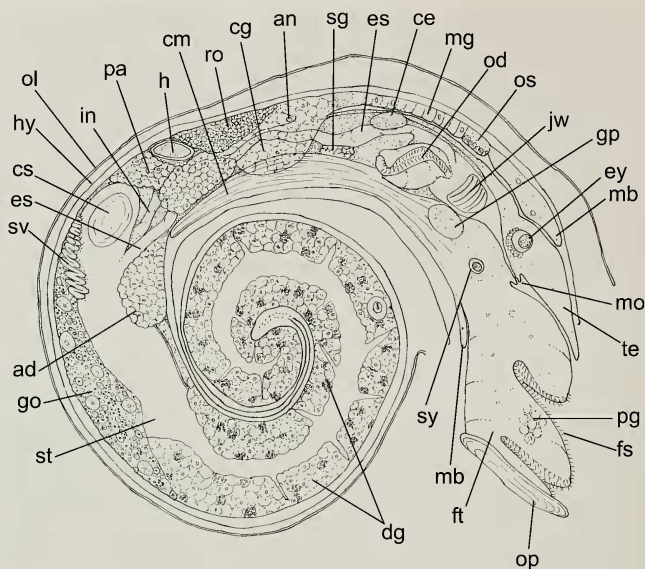
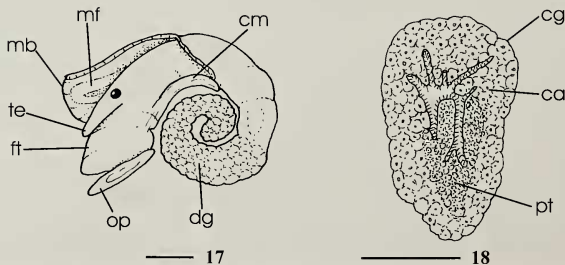


Figure 16. *Orbitestella patagonica*. Semi-diagrammatic longitudinal section. Scale bars = 100 μ m. Abbreviations in Materials and Methods.



Figures 17–18. *Orbitestella patagonica*. Anatomical details. 17. Left side view of a specimen with pallial cavity sectioned and deflected; 18. Transversal section in middle region of common glandular genital duct. Scale bars: Figure 17 = 100 μ m; Figure 18 = 50 μ m.

absent (Figures 12, 13). Esophagus originating from middle dorsal region of odontophore, initially narrow, wider posteriorly, entering stomach at anterior-ventral region at side of style sac (Figure 16); esophagus wall thick and undulated by presence of glands. Salivary glands small, ventral to esophagus and posterior to odontophore. Stomach large occupying about $\frac{1}{4}$ whorl, somewhat flat, on right side of visceral mass (Figures 10, 16). Inner gastric surface covered by cuticle. Style sac small, located in antero-dorsal region of stomach, bearing an ovoid crystalline style. Stomach lumen continuous with digestive gland. Digestive gland composed by non-pigmented vacuolar cells. Intestine short (a half of esophagus length), originating between stomach and style sac, directed forward (Figure 16). Anus located on posterior end of pallial cavity.

GENITAL SYSTEM: Gonad hermaphrodite, located between stomach and digestive gland, at left side posterior to pallial cavity, occupying 0.5 whorl (Figures 10, 16). Male tissue intermingled between female acini. Seminal vesicle anterior to gonad, very convoluted, with narrow walls. Common glandular gland duct broad, located on right side of pallial roof, bulging ventrally into haemocoel space; lumen with few longitudinal glandular folds and short cilia. Prostatic gland well differentiated, ventrally located; capsule gland covering outer region of prostatic gland (Figure 18). Genital aperture and penis not observed. Oogonia and oocytes in various degrees of differentiation, randomly distributed (found in two dissected specimens).

CENTRAL NERVOUS SYSTEM: Pair of fused cerebro-pleural ganglia located posterior to buccal bulb; pedal ganglia located ventral to oral tube. Statocyst of about half eye volume, immerse anterior to pedal ganglia into pedal musculature, with a single and relatively large (similar to eye in diameter) statolith (Figure 16).

Type Material: Holotype (MLP 6367) (720 μ m in diameter). Paratypes: 9 specimens (MLP 6368), 5 specimens (MZSP 38708 + 9 slides of serial section of 2 specimens), all from the type locality, March 1998.

Type Locality: 54°52' S, 68°12' W, Isla H, Beagle Channel, Tierra del Fuego, Argentina.

Distribution: Known only from type locality.

Etymology: The species name derives from Patagonia, region on southern part of South America.

DISCUSSION

Three species of Orbitestellidae were previously reported from the Magellanic Region and adjacent subantarctic waters: *Microdiscula subcanaliculata* (Smith, 1875) from South Georgia Islands and South Orkneys Islands (Ponder, 1983 and 1990), *Microdiscula vanhoeffeni* Thiele, 1912, from South Shetlands Islands (Dell, 1990) and *Orbitestella ponderi* from East Beagle Channel and southeastern Pacific Ocean, Chile (Linse, 2002). *Orbi-*

testella ponderi was also collected during this study along the Beagle Channel at Ushuaia Bay (\approx 54°50' S, 68° W), Gable Island (54°54.6' S, 67°21.4' W) and San Pio Cape (55°5.6' S, 66°28.8' W); at Sloggett Bay (55°00' S, 66°20.6' W) and Isla de los Estados (54°46' S, 64°22' W). These new records confirm that *O. ponderi* is partially sympatric with *O. patagonica*.

Orbitestella patagonica differs from *O. ponderi* Linse, 2002, by having a more depressed shell, with much weaker axial sculpture and rounded aperture. *Orbitestella patagonica* differs from the Antarctic species of *Microdiscula* Thiele (1912) by having a more depressed, spirally ornamented shell. The ratio of the umbilicus/last whorl diameter in *O. patagonica* is similar to that of *M. vanhoeffeni* and greater than in *M. subcanaliculata*. *Orbitestella patagonica* also differs from the Australian and New Zealand congeneric species in having a more rounded shell aperture, more rounded last whorl, and weakly defined commarginal growth lines. *Orbitestella patagonica* also differs from the North Atlantic *O. similis* and *O. cubana* by lacking nodulose sculpture and by having a more rounded last whorl.

The South American species of *Orbitestella* (*O. ponderi* and *O. patagonica*) differ markedly from the Australasian *Orbitestella* species (including the type species) and the North Atlantic species, by having crisp spiral threads covering the entire shell surface, including the protoconch. However, based on jaw morphology and general shell shape, we prefer to expand the generic set of characters for *Orbitestella* instead of introducing a new generic taxon for the South American species. Beyond these two genera, only *Lurifax* Warén and Bouchet (2001) has also been reported to the family Orbitestellidae (Smriglio and Mariottini, 2002). *Lurifax* is very different from the other genera in having taller spire and multispiral protoconch.

Orbitestella patagonica shows the general anatomical features of the orbitestellids described by Ponder (1990). The main anatomical difference is the proportionally smaller stomach, occupying only the right side of the visceral mass. Radula morphology also show some differences with those previously described and figured by Ponder (1990) as characteristic for *Orbitestella*: the pectinated cutting edge of the rachidian tooth in *O. patagonica* is wider and not as triangular as in *O. wareni* Ponder, 1990; the cutting edge of the lateral teeth were described by Ponder (1990) as a wide plate with numerous small cusps in the outer margin, while in *O. patagonica* they are narrower and having only few cusps; marginal teeth are wide and numerous cusped in the species described by Ponder (1990) and are narrow, hook-like and without additional cusps in *O. patagonica*. The jaws in *O. patagonica* have only five rows of serrated plates, while Ponder (1990) described six and seven rows for the species he studied. Both radula and jaws of *O. patagonica* are similar to those of *O. ponderi*.

Orbitestella patagonica, as it was previously reported for *O. wareni* by Ponder (1990), has the general anatomical features of a basal heterobranch, such as the lack of

ctenidium, the hermaphrodite genital system mostly bulging into the haemocoel, the lack of odontophoral cartilages and the presence of a pigmented mantle gland.

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